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## NESTING SUCCESS OF *Quelea quelea* WITH ONE PARENT REMOVED AND OBSERVATIONS ON ROOSTING BEHAVIOR, WITH IMPLICATIONS FOR CONTROL

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**ABSTRACT:** Avicidal sprays are likely to continue to be a major tool in controlling *Quelea quelea* nesting colonies when they are found in cereal producing areas. New observations on nesting behavior indicate that a single parent cannot successfully care for the nest if the other parent is destroyed before the eggs have hatched. During the incubation period, *Quelea* return earlier in the evening and males are more concentrated in night roosting areas than after the eggs have hatched. These factors indicate that for the most efficient control, the best time to spray nesting colonies is before hatching begins.

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## INTRODUCTION

*Quelea quelea* is such an important pest of cereals in the sahelian zones of Africa that many nations within the *Quelea*'s\* range have formed control organizations to deal with the problem. At present, methods of mass destruction such as use of explosives, fire, and toxicants are the main weapons in the fight against *Quelea*. Of these, aerial application of avicidal sprays is the principal method now used to kill these birds. Although this type of control is not recommended if the goal is a general population reduction, there are some situations where the destruction of *Quelea* nesting colonies can provide temporary crop protection, for example, when a cereal scheme with a crop coming into the vulnerable stages is within the feeding range of a nearby colony. Fenthion is presently the chemical of choice for killing *Quelea* due to its effectiveness on birds and comparatively low mammalian toxicity. New information on *Quelea* behavior presented herein indicates that proper timing of avicidal spraying is very important and can increase the efficiency of control operations without increasing the amount of avicide used.

The effects of aerial fenthion sprays on nesting *Quelea* have been described by Jackson and Park (1973). Many of the fledglings that survived their spray treatments were found to be unusually low in weight when compared with the control group. It was not known if the low weights of the fledglings were due to some sublethal effect of fenthion (Pope and Ward, 1972) that resulted in retarded growth of the nestlings, or if they resulted from the loss of one parent. Normally both parents feed the young (Ward, 1965) and the loss of one of them could result in underweight fledglings. This study was designed to investigate these questions. Other observations on *Quelea* behavior with implications for control are also reported.

## METHODS

The colony under observation was located about 35 kilometers north of N'djamena (formerly Fort-Lamy), Chad, in *Acacia* sp. and *Zizifus mauritania* woodland. Extensive areas of grassland composed of wild sorghum, *Echinochloa* sp., and other species were scattered throughout the savanna in the vicinity of the colony. The colony covered about five hectares.

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\* The generic name *Quelea* is used as the common name to denote the Red-billed (or Sudan) Dioch, *Quelea quelea*.

Daytime behavior observations were made from a blind at intervals of about two hours throughout the day and during daily walks through the colony. Nighttime observations on nesting and roosting were made at intervals of one or two days. To determine nesting success of a single parent, one of the two parents was trapped from 104 nests using fishline nooses installed at the nest entrances. One to twelve captures were made at intervals of one to two days during the incubation, hatching, and nestling stages. Nestlings were weighed with a 30 gram Pesola spring balance one day before the onset of fledging.

## RESULTS AND DISCUSSION

### Nesting Success with One Parent Removed

During incubation -- Removal of one parent during the incubation period resulted in the failure of the eggs to hatch. In a very few cases, when the capture was made only a day or two before hatching occurred, some eggs did hatch but the young were not cared for and died. Abandonment of the nest by the remaining parent was thought to be the cause of nest failure. This abandonment was probably caused by the interference of other *Quelea* from neighboring nests. *Quelea* normally defend a small territory of a several-centimeter radius around the nest. With only one parent tending the nest, there were periods each day when the nest was left unguarded. Unguarded nests were visited by birds from neighboring nests, mainly males, who removed pieces of nesting material, thus creating holes and enlarging nest openings. Such damaged nests were soon abandoned. Crook (1960) experimentally damaged nests by removing small amounts of nesting material and reported the desertion of nearly all such damaged nests.

When females are removed during the incubation period, it is unlikely that the nest could succeed even if the male did not desert because only the females incubate at night. If the eggs are not incubated for a few nights they are unlikely to hatch.

A high percentage of abandonment by other incubating birds in the vicinity of the experimental nests was also observed and was probably due to the interference caused by the daily visits by the investigator. These daily visits did not noticeably disturb nests once nestlings were in the nest.

After hatching -- In most cases where an adult was removed during or after the hatching period, the remaining parent was able to rear the young to fledging. The more time that elapsed between hatching and the loss of one of the parents, the greater was the likelihood of the survival of the young. This trend is illustrated in Figure 1. Single parents of either sex raised their young to fledging more than 80 percent of the time. Nests with both parents were successful in fledging young more than 90 percent of the time.

Nestlings fed by females had a mean weight of  $12.5 \text{ g} \pm 2.8 \text{ s.d. (n=23)}$ , and were not significantly heavier than those raised by males which had a mean weight of  $11.7 \text{ g} \pm 3.3 \text{ s.d. (n=21)}$ . Both groups were lighter than young fed by both parents which had a mean weight of  $14.3 \text{ g (n=146)}$ . Brood sizes were also smaller when a single parent cared for the young. These data were taken from 20 nests (ten with the female removed and ten with the male removed) having equal numbers of young on the dates of capture. Captures were made between the first and sixth days after hatching. The comparisons were made on the ninth day after hatching. These experiments were repeated with similar results by Barre (1973) who removed a parent from each nest by shooting. The only exception was one female which successfully fledged young after the male was removed late in the incubation period. These results strongly suggest that the lightweight fledglings observed following the spray trials by Jackson and Park (1973) were birds that had been raised by one parent, the other parent having been killed by the avicide.

### Other Observations on Behavior with Implications for Control

Males roost in dense concentrations at night -- Nightly checks to determine which sex was on the nest at night confirmed the observations of Morel and Bourlière (1955) that only females brood at night. In most parts of the colony only a few males were seen at night among the nests. The explanation for this scarcity of males was discovered when dense concentrations were found roosting in certain spots in the colony. These concentrations were found in the same locations each night. Following hatching, males were more dispersed than previously, but after fledging, they were again densely concentrated in these roosts. No account of night roosting concentrations of male *Quelea* in nesting colonies has come to my attention.

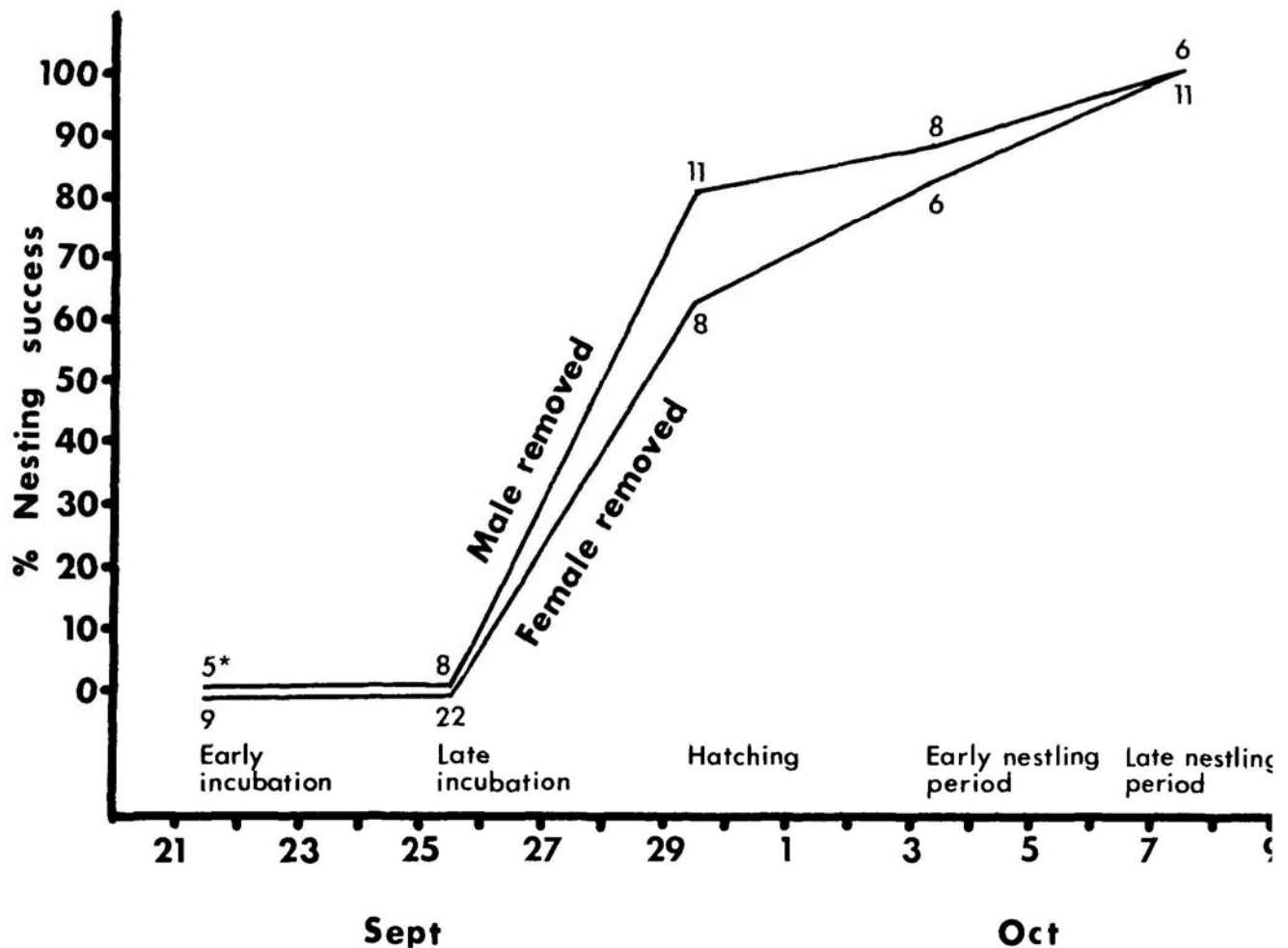


Figure 1. Nesting success of *Quelea qualea* with one parent removed at different stages in the nesting cycle. A nest was defined as successful if it fledged one or more young, numbers indicated on graph represent number of nests in sample.

Male roosts within the colony probably account for the unexplained uneven sex ratios observed after avicide spray treatments of nesting colonies. Uneven sex ratios following treatments are well known to *Quelea* control organizations (Meinzingen, 1974) and were reported by Jackson and Park (1973) in their spray trials. Perhaps ground spray operations can be made more efficient if control teams can locate these roosts and concentrate their efforts on them.

*Quelea* return to the colony earlier during the incubation period -- Also of interest to control operators is the hour of treatment. Aerial sprays are most effective just before dark when most of the birds are in the colony. When aircraft are used, there are only a few minutes of good spray time before spraying must be terminated due to the hazards of low flying at night. In the colony under observation, the parent birds returned to the colony earlier in the evening during the incubation period than after the eggs had hatched. Before the eggs had hatched, flocks of males could be seen cruising the colony at dusk and capture of both sexes in mist nets was easy in the late afternoon hours. During the time when the parents were feeding young, capture with nets during late afternoon was difficult until shortly before dark. An explanation may be that the adults must spend more time away from the colony gathering food after the young have hatched. The effective time for aerial spraying is longer during the incubation period than later in the nesting cycle.

## SUMMARY OF RECOMMENDATIONS FOR CONTROL

When avicidal sprays are used to kill *Quelea* in nesting colonies, treatment early in the nesting cycle is likely to be much more effective than late treatment. The ideal time would be during incubation, well before the eggs are likely to hatch. At this stage the parent birds are returning to the colony relatively early, thus allowing more time to spray before dark. Males are concentrated at night, which makes them vulnerable to ground sprays, and the loss of a single parent, either male or female, is likely to result in abandonment of the nest by the other parent. Thus, if one parent from each nest were killed, a 50 percent kill could theoretically result in 100 percent nest failure. Such an expectation is not unreasonable since one parent is generally at each nest in late afternoon during the incubation period. Because *Quelea* in breeding condition often appear suddenly in an area and begin to nest after only a few days, it is very important to have a good scouting system to locate colonies quickly so that they may be treated before hatching occurs. Application of this new information should allow more complete kills without increasing the amount of avicide used.

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